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The Nova Scotia Herbicide Trial

The Nova Scotia court case on the proposed use of 2, 4-D and 2, 4, 5-T by Nova Scotia Forest Industries has aroused great interest in Canada and the United States. Although the case deals with the use of herbicides by a forest industry, the principles involved, the presentation of the case, and the judge's summation and decision are of interest to everyone dealing with pesticides.

In 1982, Nova Scotia Forest Industries presented their proposed spray plans to treat selected cutover and regenerating sites with herbicides as part of their long-term management program. The products proposed were Esteron 600 (containing 2, 4-D), Esteron 3-3F (2, 4-D + 2, 4, 5-T), and 2, 4, 5-T. These products are all registered for forestry use in Canada under the Pest Control Products Act. It should be noted that in Canada, the Provinces may restrict or ban the use of pest control products within their jurisdiction and 2, 4, 5-T is, in fact, banned in British Columbia, Saskatchewan, and Ontario. At the time of the 1982 review, when it appeared that the spray program would be approved even though there was concern over the use of the products, a group of citizens in Nova Scotia applied for, and was granted, an interim injunction restraining any spraying by the defendant. The Nova Scotia Court of Appeal lifted the injunction in December 1982 on the grounds that no spraying could take place until 1983. (Note: the original injunction pertained only to the 1982 spray program). On May 2, 1983 the case came to court with the claim being a permanent injunction against the use of 2, 4-D and 2, 4, 5-T.

The trial aroused great interest since it was obvious that the decision would have far-reaching implications. The plaintiffs in the trial were a group of citizens, farmers, small landowners, and representatives of the Whycocomagh and Afton Indian Reserves, 15 people in all. The defendants were the Nova Scotia Forest Industries. During the course of the trial the plaintiffs' case was supported by 35 witnesses and the defendants' by 14. In acknowledgement of the importance of the case, the public interest attached to it, and the significance of the decision, Judge J. Nunn carefully reviewed the testimony of each plaintiff and the witnesses and submitted a lengthy decision.

In reviewing the case I would advise any person interested to read the decision; although it is a legal document and lengthy, it is well written and very interesting. Basically the plaintiffs claimed that the use of the herbicides as proposed by Nova Scotia Forest Industries would impose a health risk, due to drift of the spray and runoff into streams and lakes, and would also create damage to the aquatic and

terrestrial ecosystem to prevent the people from collecting fish, eels, oysters, berries, roots, and herbs as was their custom. The defendants argued that as a forest industry interested in maintaining a continuing source of wood through effective management plans, they had to treat selected areas for site preparation and to release the young conifers from undesirable competition.

The forest industries in Canada are at a disadvantage in that there are basically only the two herbicides, 2, 4-D and 2, 4, 5-T, available for use; 2, 4, 5-T is restricted in some of the Provinces and under certain conditions, it is the only effective material. In reading Justice Nunn's decision one is impressed by the amount of evidence that shows the dioxin 2, 3, 7, 8-TCDD is an acknowledged toxic hazard. But with the amount present in 2, 4, 5-T and the application rates used, fears about the forestry use of 2, 4, 5-T are unwarranted. In many cases the evidence showing the toxicity of the material was based on exposure rates much higher than what occurs in a forestry use pattern. Also when many studies were examined in detail they were found to be flawed, e.g., the Alsea studies and the data from Hardell in Sweden. The past concern over dioxin toxicity resulted in intensive reviews being carried out in the United Kingdom, Australia, New Zealand, the United States, and Canada. In each of these studies the conclusion was generally the same, "In spite of voluminous data on the biological effects of the phenoxy-type pesticides and their associated chlorinated dioxins, which often times exist as contaminants of the pesticide formulation, there is still very little substantive evidence for many of the alleged claims that have been made against these compounds."

A key point in the case was that of burden of proof. Justice Nunn commented that for an injunction to be upheld, irreparable harm must be proved "quia timet" and that this was not so in this case. Justice Nunn also commented on "Operation Ranch Hand" — the use of herbicides in the Viet Nam conflict. The purpose was to defoliate areas *as completely and as quickly as possible*. Thus the mixture of 2, 4-D and 2, 4, 5-T, known as Agent Orange, was sprayed without dilution in massive quantities. This is definitely not the practice in forest management and was never proposed by Nova Scotia Forest Industries, therefore, parallels cannot be drawn between the two operations. I think it is also worthwhile quoting directly two paragraphs made by Justice Nunn (Nova Scotia reports (2) Palmer et al vs. N. S. Forest Industries, p. 354, para. 594 and 595).

594 "To my mind, after hearing all the evidence and reading all the exhibits, there is no doubt that the weight of current responsible scientific opinion does not support the allegations of the plaintiffs. I feel it is my responsibility, in view of the nature of this matter, to add that, while I do not doubt the zeal of many of the plaintiffs' scientific witnesses or their ability, some seemed at many times to be protagonists defending a position, thereby losing some of their objectivity. There was a noticeable selection of studies which supported their view and a refusal to accept any criticism of them or contrary studies. Where the study was by anyone remotely connected with industry there was a tendency to leap to the "fox in the chicken coop" philosophy, thereby ruling out the value of the study as biased. In my view a true scientific approach does not permit such self-serving selectivity, nor does it so readily decry a study on the basis of bias."

595 "I had the opposite impression of the scientific witnesses offered by the defendant. I did not detect any sense of partisanship. They related their work, their involvement with the substances, the results of their studies in a professional, scientific manner and I therefore found their opinions to be reliable and, indeed, I accepted them as such."

The decision was that 2, 4-D and 2, 4, 5-T can be used in safety and without risk to the citizens of Nova Scotia.

Justice Nunn ruled that the plaintiffs had failed in their action and the defendant was entitled to costs.

The decision was widely publicized across Canada with the newspapers picking up the theme of the poor innocent farmers being forced to sell their homes and properties to pay the costs of Nova Scotia Forest Industries. Advertisements and appeal notices were placed in newspapers appealing for funds to pay the costs. The final statement was made on December 12, 1983 by Nova Scotia Forest Industries. They stated that the company never had the intention of taking peoples' homes or farms or interfering with their livelihood to pay costs. Following meetings between the plaintiffs and Nova Scotia Forest Industries, it was agreed that the plaintiffs would pay to the company the funds collected through public subscription to pay the defendants' costs. The company will donate these funds plus a matching contribution from the company to provide scholarships for Nova Scotia students studying forestry. It is also worth noting that the plaintiffs will not be appealing the case.

As an observer, I find it frustrating that the public and the press have chosen to ignore this landmark court case and continue to press for the complete ban on these products.

J. A. Armstrong — Canadian Forestry Service
Ottawa, Ontario

Abstracts from the Eastern Spruce Budworm Research Work Conference

The University of Maine at Orono was once again the site for the annual Eastern Spruce Budworm Research Work Conference, held January 10-11, 1984. The organizers summarized the conference's theme as "the economic impact of the spruce budworm to the spruce-fir wood supply and the impact of a supply shortfall on the economy of the region." The 150 registered attendees received a copy of the proceedings for the meeting at the door, containing abstracts of all the presentations and a schedule of lectures on January 10 and concurrent workshops on the next day, January 11. Mel McKnight, who attended the conference, was once again impressed with the "Maine-iacs" handling of convention details. (CANUSA hopes they don't lose their touch before our international symposium in September.)

The following abstracts, selected from the proceedings but by no means an exhaustive sample, reflect brief summaries of the talks given on day one. The *Newsletter* is reprinting the abstracts as examples of widely differing viewpoints on the spruce budworm problem in the East.

Update on Current Outbreak Conditions in the Northeastern United States.

Henry Trial, Jr., Maine Forest Service, Old Town.

Both Maine and Vermont experienced increases in defoliation in 1983. In Maine the area of moderate to severe defoliation increased from 3.8 to 4.0 million acres (1.54 to 1.62 million ha). In Vermont the defoliated area increased from 153,852 to 178,086 acres (62,263 to 72,070 ha). Maine and Vermont conducted spray projects of 860,000 and 1411 acres (348,037 and 571 ha), respectively.

Budworm populations and resulting defoliation were at low levels in New Hampshire in 1983.

Population prediction surveys conducted in Maine and Vermont show significant reductions in population levels predicted for 1984. In Maine, the area in high and extreme hazard predicted for 1984 is somewhat reduced from 1983 levels largely due to lower predicted populations.

The Maine Spruce-Fir Supply/Demand Analysis—Implications.

Tom Rumpf, Maine Forest Service, Augusta.

In June 1983 the Maine Forest Service/Department of Conservation released the long-awaited Maine Spruce-Fir Wood Supply/Demand Analysis. This analysis was originally commissioned in 1981, to "determine the types and levels of future spruce budworm protection needs and strategies for such spruce and fir resources."

Limitations of the analysis prevent a clear determination of the total acreage requiring budworm protection. However, the analysis clearly demonstrates that without (1) a strategic combination of accelerated investments in more intensified forest management; (2) improvements in wood utilization both in the woods and in the mills, and (3) continued protection from budworm growth loss and mortality, the State's spruce-fir forest will be driven into an unproductive structure that will not continue to support the current level of spruce-fir harvest.

The most productive combination of investments for a given mill and/or landowner cannot be determined without more detailed regional or mill-specific analyses.

Further analyses of this kind must be initiated promptly and must be followed by timely investments in intensified management and improved utilization. Delaying further analyses and the initiation of strategic investments will ensure that Maine's spruce-fir forest will be unable to sustain the current level of spruce-fir harvest beyond the first decade of the 21st century.

Spruce-Fir Wood Supply/Demand Analysis—Maine Industrial Landowner's Viewpoint.

H. A. Magnuson, Paper Industry Information Office, Augusta, Maine.

Managers of paper company woodlands have examined a spruce-fir wood supply/demand analysis completed in 1983 for the Maine Forest Service and found it generally valid as regards supply trends for the State as a whole but inadequate in several respects, including economic factors involved. The industrial foresters point to reliance on a data base, which was not current and failed to recognize corrective actions initiated in years past and intensified by the industrial fears, as they faced rapid deceleration of tree growth and increased tree mortality because of repeated defoliation by budworm.

There is a consensus that the analysis is inadequate for regional, wood marketing area, or ownership application, and does not address regional differences in spruce-fir distribution, other susceptible species, age classes, response of trees to budworm attack and to spray protection, etc.

Industrial foresters question the timing of a threshold and duration of the projected wood shortfall period because of the assumptions used and the failure to recognize silvicultural and utilization interventions already in place and additional interventions to be made.

Budworm research has yet to (1) isolate factors contributing to collapse of epidemic infestations, and (2) find ways to enhance development of such factors. Operational research is needed for more efficacious and less costly spray materials and application methods. Comparative results and costs of the various silvicultural and utilization options must be researched to provide a basis for development of an integrated pest management program.

Spruce-Fir Wood Supply in New Brunswick in Relation to a Continued Spruce Budworm Epidemic.

T. A. Erdle and M. D. MacFarlane, New Brunswick Department of Natural Resources.

The current average requirement of spruce-fir by the New Brunswick forest industry is approximately 3.1 million cords (7.9 million m³) while the total sustainable supply from New Brunswick forests is about 2.8 million cords (7.1 million m³).

The shortfall in supply from New Brunswick sources is made up by net imports of about 314,000 cords (0.8 million m³) from Quebec and Maine. The New Brunswick softwood forest industry cannot expand for the next 35–40 years and, in fact, may be forced to reduce production if unexpected losses from budworm defoliation occur.

The spruce budworm has been a significant insect pest in New Brunswick since 1952. Losses in wood volume through tree mortality have been documented. However, little information is available on growth losses.

Part of the effect of growth losses and mortality due to budworm defoliation have been taken into effect in estimating sustainable softwood supplies in that the condition of the forest in 1980 reflected 30 years of budworm epidemic combined with the protection program carried out over the same time period.

The most significant impacts of budworm are increasing mortality in mature and overmature stands and reduced growth in regenerating and immature stands. The magnitude of these impacts in different species associations, together with how the forest is distributed across developmental stages, should be addressed in the design of management alternatives regarding allocating protection and scheduling the harvest sequence through the forest. Currently in the Province, a system is being designed which attempts this by linking a stand growth model, a wood supply forecasting model, the newly compiled forest inventory, and the New Brunswick Department of Natural Resources' Geographic Information System. For the system to provide useful results, additional research is needed in the area of quantifying the effects of defoliation on growth in younger stands and mortality in mature stands.

Quebec's Spruce-Fir Supply: Short Term and Long Term.

Claude Godbout, Quebec Department of Energy and Resources.

Quebec's productive forests cover more than 193,050 square miles (500,000 km²), 50 percent of which are occupied by mature stands. This area contains more than 1.6 billion cords (4.1 billion m³) of merchantable timber, of which spruce and fir make up two thirds of the total, or about 1.06 billion cords (2.7 billion m³).

Even if such large resources hardly seem to lead to wood supply difficulties, spruce-fir supply, which is about 90 percent of the volume needed by Quebec's forest industry, is nevertheless a concern in Quebec. In the short term, we have, Province-wide, enough standing merchantable volume to sustain the present forest industry for more than 50 years, even without counting on growth during that period (the present annual requirement is around 10.6 million cords (27 million m³) and should eventually reach 12.2 million cords (31 million m³). In 25 years, however, the first supply shortfall may begin to appear in some regions of Quebec. In the long term, we need to access both the northern part of the commercial forest and increase our annual allowable cut from 9 million cords (extensive forestry) (23 million m³) to 12.5 million cords (32 million m³). Many steps have been taken in recent years toward that goal, and we are well on the way to reaching it. Unfortunately, the problems have recently been amplified by damages caused by the spruce budworm, producing an oversupply of logs in the short term and threatening to reduce the allowable cut even further in the long term.

However, even if the new allowable cut appears sufficient to cover the spruce-fir requirements over the long term, this overall picture does not reflect either the local shortages forecasted in 25-30 years in southern Quebec nor the additional requirement in spruce-fir that may be needed because of the continuous development of Quebec's forest industry. In such a context, we are really aiming at managing the forest to meet present and future industry's requirements. Therefore, now more than ever, we cannot afford to lose timber for a lack of adequate protection of our present merchantable timber, especially in the most accessible areas of Quebec. That is the whole context of the impact of the spruce budworm on Quebec's spruce-fir supply.

The Economic Impacts of Spruce Budworm on State and Provincial Economies.

Charles S. Colgan, Senior Economist, Maine State Planning Office, Augusta.

Spruce-fir-based industries in northeastern North America account for substantial shares of manufacturing employment; however, their real significance lies in their major role in the export base of these economies. Major changes in the resource base would have significant effects throughout State and Provincial economies.

The extend of those effects will be a function of the changes in the forest products industries' economics brought on by the imbalanced age-class structure of the forest and the current spruce budworm outbreak. These industries are facing a change from an abundant resource base to a managed resource at sustained yield levels, with a forecast of declining yields in the future.

Major economic effects of this change will include substantially increased uncertainty concerning future supplies and costs that, combined with the long lead times in forest products investment, will make all investments increasingly risky. This will result in increased capital costs that will accompany the overall increases in production costs caused by more intensive forest management, spruce budworm control measures, and the investment in technologies for more intensive resource utilization. Projected wood surpluses through the next decade will probably keep wood prices low, placing additional pressure on the economics of timber culture investments.

These supply problems will be joined by potential demand problems as well. Markets served by the northeastern spruce-fir industries are generally mature, with little prospect for large growth.

The combination of supply and demand factors will result in some shrinkage in the industry. The extent of shrinkage cannot be accurately forecast now. Shrinkage may be partly offset by better use of existing species and underutilized species, and by increasing the number of wood manufacturers in the region, but the extent of this offset is speculative.

Several effects will also occur beyond the direct changes in forest products harvesting and processing. Changes in the nonharvesting uses of the forest will occur, and pressure may be put on other resources. The Big A project proposed by Great Northern Paper is an example of some of the choices that are imposed by necessary changes in wood utilization.

The Spruce Budworm and New Brunswick's Private Woodlots: Current Effects and Future Shortages.
D. S. Curtis, New Brunswick Federation of Woodlot Owners, Inc., Fredericton.

Managing the budworm problem on small nonindustrial forest holdings poses substantially different problems than are encountered on larger industrial and government holdings.

Owned by thousands of individuals from every conceivable background, and ranging in size from an acre to hundreds of acres, woodlots represent a valuable source of wood supply to industry. However, forest management is not widely practiced nor uniformly applied, and forest protection against budworm has been sporadic at best, resulting in an immediate surplus and leading to a long-range shortage of softwood fiber. On New Brunswick woodlots alone, it has been estimated that there are 10 million cords (25.5 million m³) of spruce and fir in the defoliation classes ranging from "moderate" to "dead more than 1 year." Most of this wood will not be salvaged and represents a loss to woodlot owners and the Provincial economy of hundreds of millions of dollars.

Effects of this devastation on future wood supplies will become apparent as better inventory data become available, but it has already resulted in unbalanced age structures and public disillusionment. Future wood production on woodlots will also depend to a large extent on the Province's willingness to protect them where required; choice of insecticide; and on the owners' willingness to accept protection, adopt appropriate management practices, and make their properties available for harvest.

An integrated approach must be developed on woodlots addressing protection, management, and harvest. Influencing one activity out of context with the others risks alienating the owners, and thus the woodlot resource.

The Budworm in Maine's Forest: Some Daydreams and Nightmares of a Conservationist.

Charles E. Hewett, Executive Director, Maine Audubon Society, Falmouth.

The potential shortfall of spruce and fir in Maine results from a complex combination of factors: the natural and cyclic recurrence of the spruce budworm, historical timber harvesting practices, intensifying competition for the spruce-fir resource, and failure to achieve an adequate balance between production facilities and the management and availability of timber. Resolving this issue in a satisfactory manner will be a difficult task at best.

As a conservationist my worst nightmare is that we will deal with the potential solutions to the spruce-fir shortfall on a piecemeal, rather than systematic, basis. Some so-called solutions are really not solutions at all, and in any event, have unacceptable environmental implications. These include, for example, the relaxation of road and skid trail standards, abandonment of LURC'S PSL-1 and PSL-2 zoning, and the increased use of taxpayers' money to protect the private values intrinsic in the State's forests. Other solutions, for example the increased application of herbicides and insecticides, may contribute somewhat to the increased production of high-value forest products, but have environmental implications that must be carefully weighed in each instance. A third category of solutions makes sense from both a forest-protection and environmental perspective. These include more responsible management, prompt regeneration and early thinning of forest stands, more complete use of whole-tree biomass, utilization of currently unused species, construction and maintenance of a permanent road network, increased education of nonindustrial landowners regarding the potential financial returns from intensified forest management, and the encouragement of secondary manufacturing to achieve more value added before the State's forest products leave Maine.

More important than any of these individual solutions, however, is the development of a systematic and realistic framework with which to understand their implications. Understanding the complex interplay of biological, economic, social, and political factors that have caused the current spruce-fir shortfall will be essential to preventing its repetition. Such an undertaking can come only from interdisciplinary cooperation among the many groups with concerns for and interest in Maine's forests.

Overview of Operational Considerations in Expanding the Use of B.t.

J. R. Carrow, New Brunswick Department of Natural Resources, Fredericton.

Four major factors—effectiveness, cost, operational considerations, and environmental constraints—combine to determine the potential for expanded use of B.t. against spruce budworm. The latter three impinge directly on the economics of B.t. application. Recent operational experience (1980–83) with B.t. in Ontario, Quebec, New Brunswick, Nova Scotia, and Maine shows that the average unit cost of B.t. has dropped from \$0.68 (Canadian) per BIU in 1980 to \$0.32/BIU in 1983. Total insecticide cost has also decreased from \$5.33/acre (\$13.18/ha) to \$2.82/acre (\$6.96/ha), despite a general increase in application rate from 8 BIU/acre (20 BIU/ha) to 12 BIU/acre (30 BIU/ha). Steadily increasing aerial application costs have nullified this decrease, with the result that total application cost has remained fairly constant since 1980, i.e., about \$10.93/acre (\$27.00/ha). Although some agencies (Quebec, New Brunswick) report that the application of B.t. costs 2.5 to 3.0 times more than chemicals, the cost difference in Ontario and Maine is less, with B.t. application costing about 1.5 times as much.

The major operational difficulties experienced with B.t. include narrower spray window, deterioration of diluted (mixed) B.t., higher finished spray volumes, and variability in product potency and application characteristics. Balancing these factors are the advantages of minimum occupational health hazard and environmental impact, the lack of costly environmental monitoring, and greater public acceptance.

In some jurisdictions, B.t. can be used to protect areas where chemical use is not allowed by regulatory agencies. However, in some Provinces, regulators impose virtually the same restrictions on B.t. use as on chemical use.

Major research and development needs include improved B.t. strains, lower application volumes, and product improvement to increase residue activity of applied B.t.

The second day of the work conference was divided into two special-interest workshops. In Session I, Don Moen covered recent experiences in spray technology, reviewing trials at Thessalon, Riviere du Loup, and Arizona. Bart Blum and his guest speakers tackled some of the big questions about silviculture: Have your experiences with silviculture to alleviate budworm been successful? How do silvicultural efforts fit into an integrated pest management context over the long term (a rotation) or the short haul (a harvesting cycle)? Bart introduced a distinguished group of university, industrial, and government-affiliated cooperators who shared their opinions before the discussion was thrown open to attendees. Bart's experts included Bob Seymour (University of Maine), Mike Dann (Seven Islands), Marcia McKeague (Great Northern), Bill Sylvester (Interna-

tional Paper), Reg Elwell (Dead River Co.), Phil Malerba (St. Regis), Bob Locke (Maine Forest Service), and Carl Forrest (Prentiss Carlisle).

Session II featured three discussion topics. John Dimond moderated a panel on the development of biological insecticides against budworm. As expected, B.t. occupied center stage. Norm Dubois covered the development of new strains and their effectiveness on spruce budworm and other forest pests. Kathleen Murray and John described their University of Maine field test of the new Dubois strain (NRD-12) of B.t. Ed Kettela discussed the effects of B.t. foliage deposit on trees and the budworm. Finally, Michel Pelletier spoke on the use of B.t. from large aircraft. Richard Soper gave listeners an update on the development of fungi for spruce budworm control.

The second part of Session II, Environmental Impacts, was chaired by Steve Oliveri of the Maine Forest Service. Jay Krall, a private consultant, gave the results of the 1983 environmental testing of Zectran DB. Maine's long-term environmental monitoring project was described by Bud Brown of Eco-Analysts, Inc. Steve wrapped up the panel presentation with a talk on environmental risk assessment of spruce budworm insecticides.

The last part of Session II featured seven talks on various aspects of harvesting technology. Only two of these involved budworm: H. M. Schiltz and Tom Corcoran's discussion of the spruce budworm epidemic and computer technology, and B. F. Hoffman's presentation on spruce budworm presalvage.

Next year's meeting of the Eastern Spruce Budworm Research Work Conference is scheduled for early January in Fredericton, New Brunswick, the first time out of the greater Bangor area.

Sampling and Survey Workshop in May

Dan Twardus, CANUSA representative in Forest Service Region 6, announces a Program-sponsored workshop designed for pest-management specialists. Scheduled for May 1–2, 1984, in Portland, Oregon, the meeting will focus on two kinds of activities—how to sample budworm and how to evaluate proposed management actions.

Sampling and survey methods for estimating budworm populations will be reviewed on May 1. Topics to be covered include pattern of budworm occurrence within and among trees, fixed-size plots, and sequential sampling methods.

On May 2, processes will be outlined by which proposed management actions can be evaluated. Use of the combined Prognosis-Budworm Model and harvest-yield schedules will be described.

Interested participants should contact Dan (FTS 423-2727 or 503 221-2727) or Jim Colbert (FTS 423-2034 or 503 231-2034) for more information.

Modelling Workshop in May

CANUSA-West is sponsoring a workshop on the combined Prognosis-Budworm Model, to be held May 21-25, 1984, in Moscow, Idaho. Topics to be covered include an overview of the Prognosis Model (particularly its linkage to the Budworm Model and the simulation of several forest stands in parallel), a description of the Budworm Model (processes included, treatments represented, options available), and input requirements and output options. Participants will work in small groups to learn how to use the models (entering data, selecting options, interpreting output) and explore model behavior for several case studies.

If you are interested in participating in this workshop, contact workshop coordinator Larry Stipe at (406) 329-3285 or FTS 585-3285. Larry is located at the USDA Forest Service, Northern Region, P.O. Box 7669, Federal Building, Missoula, MT 59807.

International Research Symposium: The Lineup

Ron Stark and Chris Sanders, program chairmen for CANUSA's September research symposium in Bangor, have announced the names of participants invited to give synthesis presentations.

On Monday, September 17, Max McFadden and Charlie Miller will moderate a panel on the biology, ecology, and population dynamics of the spruce budworms. Invited speakers and their topics include George Harvey on taxonomy, J. R. Blais and Roy Shepherd on the biology of eastern and western species, and Jan Volney on comparing the population dynamics of the eastern vs. western budworms.

Monday afternoon's workshop will cover population dynamics in more detail. Again, Max and Charlie keep order, while a stellar cast of budworm investigators discuss a historical review of population dynamics, predators, diseases, parasites, budworm behavior, host-plant interaction, and theory. At presstime for this issue, names of workshop participants had not been finalized; but they will be printed in our next issue.

Tuesday morning, September 18, Bill Waters and Ken Runyon will convene their session on economic and social impacts of the budworm in North American forests. Invited speakers include Dave MacLean on forest productivity, Tom Bible on socio-economics, Brian Stocks on fire and the budworm, and Nick Crookston on projecting budworm impacts.

The Tuesday afternoon workshop on population impact assessment will continue in this vein with discussions of insect numbers, their quantitative impact on growth and yield, and the quantitative impact of budworm on other resources.

Wednesday morning, September 19, Wyman Schmidt and Bill Varty will moderate a panel on tactics and strategies for prevention and suppression of damage by spruce budworms. Bart Blum and Clint Carlson will cover forest protection via silviculture in the East and West, respectively. Jack Armstrong and John Cunningham will cover population manipulation with chemical and biological controls.

Two concurrent workshops will vie for attendees' attention on Wednesday afternoon. Wyman Schmidt will head the discussion of forest stands and the budworms, focusing on susceptibility/vulnerability, hazard rating, and silvicultural remedies. Bill Varty's guests will speak on foliage protection and population management, including chemicals, biorationals, application technology, and environmental impact assessments.

Thursday morning, September 20, the symposium's final day, Gordon Baskerville and Ron Stark cochair the presentation of synthesis papers on integrated forest and pest management and their implications for forest management. Gary Simmons and Wilf Cuff (coauthors of the IPM chapter in "Managing the Spruce Budworm in Eastern North America") speak for the Easterners, while Al Stage represents the West on this subject.

Thursday afternoon Bob Blomquist, regional silviculturist for the 20-State Region 9 of the USDA Forest Service, convenes a panel of industrial and governmental users of CANUSA's technology to discuss to overall impact of the Program. They will tackle the big questions: How successful have we been in meeting the needs of forest management? What remains to be done?

Full details about speakers, side trips, entertainment, and what-to-do-with-your-spare-time-in-Bangor will be covered in the next issue of the *Newsletter*.

We can tell you now that not one but two silvicultural demonstration tours are planned—one by Bob Blomquist and Jim Hanson in the Lake States and the other by Tom Skratt and Ed Kettela in the Maine-Maritimes area.

The Lake States demo, the week of July 9, will leave from Rhinelander, Wisconsin, and loop through upper Michigan, returning to Rhinelander late Friday, July 13.

The eastern demo will be held the week of September 10, immediately preceding the symposium. Attendees will start with a half-day tour of budworm operations in the greater Bangor area, including the university's experimental forest. Tuesday, the tour heads out for New Brunswick, with stops at St. Regis land, Fredericton, Edmundston, Riviere du Loup, Laurentides Park, and Quebec City. On Saturday, September 15, the tour returns from Quebec to Bangor.

There will be no charge for either tour, but attendees will be responsible for their hotels and meals. Tour planners are nailing down block reservations. The May *Newsletter* will feature complete itineraries for both trips. Meantime, here are your contact points for more details:

Lake States tour—Bob Blomquist (FTS 362-3170 or 414-291-3170); Jim Hanson (FTS 784-0324 or 612-642-5324)

Eastern tour—Tom Skratt (FTS 833-7833 or 207-866-4140); Louis Archambault (418-694-3927).

Newsletter readers should have received a bulletin about the Symposium from Fred Knight, overall chairman, during February. In case you missed this mailing, please note that the symposium will start bright and early on Monday morning, September 17. This is one day earlier than originally planned. You will need to arrive Sunday night, the 16th, for registration. To catch up with reservation details, contact Fred at (207) 581-2844.

Personnel

Jimmie Joe Colbert, mathematician and Research Coordinator at CANUSA-West, has taken over the reins as Program Manager for the last 9 months of CANUSA. Ron Stark's appointment (we borrowed him from the University of Idaho) could not be formally extended beyond the first of this year, so Pacific Northwest Forest and Range Experiment Station Director Bod Ethington named Jim to take over. Ron remains with us in Portland, though, actively engaged in organizing our international symposium and in helping management finalize publications in the western component's challenging technology transfer effort.

Items from the Press

Christmas Trees Ruined by Bug.—An insect infestation in eastern Oregon has ruined most of the Christmas trees this year in the national forests in the Baker and La Grande areas.

The cause of the problem is the spruce budworm, which has attacked numerous trees, particularly their top growth.

"We have a moderate to heavy infestation with 30- to 50-percent defoliation, depending on the species. Douglas-fir and white fir are the trees which the budworm appears to like the best, but it also attacked some pines," Kerry Crist of the Unity Forest Service unit said.

He said the Unity area has been hit the hardest, with practically every tree affected.

Normally the Unity area issues approximately 1,200 permits to cut Christmas trees each year. Some are for commercial cutters, but most are to individuals.

"This year (1983) we aren't issuing commercial permits. The quality just isn't there. If you look really hard you may find a tree, then have to drive 2 or 3 miles before you find another," Crist said.

Control measures are under study for the Umatilla, Malheur, and Wallowa-Whitman national forests, Crist said. Rick Turnbull of La Grande, leader of the control measures study, said good results were achieved in areas sprayed in 1982-83 and he anticipates more spraying in 1984.

(United Press International — November 30, 1983)
Unity, Oregon

Budworms Eating Up Vermont Forests, Dollars.—Experts worry that the scenario that has taken place in Greensboro—budworm infestation, dying trees and the final clear-cutting—will be repeated as the insect eats its way across the Northeast Kingdom.

"We've got an outbreak, a serious epidemic," said E. Bradford Walker, director of forests for the state Department of Forests, Parks and Recreation.

Tree experts, landowners and state officials are fighting back with a demonstration project in a three-county area around Greensboro. They are combining spraying with new methods of forest management in hopes of slowing the insect's onslaught.

"Right now, we're looking at annual losses of \$4 million to \$5 million," said Bruce Parker, a University of Vermont entomologist who is active in the demonstration project.

Forest land takes up 4.5 million of Vermont's 5.9 million acres, according to state figures. About 785,000 acres of that forest consist of a mix of spruce and fir trees, the budworm's favorite diet. The budworm has caused defoliation in 23 percent of that spruce-fir forest.

Defoliation was found in 153,852 acres of Vermont forest in 1982, Walker said. The preliminary total for 1983 is 179,625 acres. Roughly half of that area was heavily defoliated, with 75 to 100 percent of the needles missing on the trees.

The state's first spraying program was approved early in 1983 by the Vermont Legislature. Half of the \$30,000 cost was financed by the federal government, with another 25 percent coming from the state and the remainder from 31 landowners. The 1,712-acre spray area included Greensboro, Hardwick, Wheelock, Lyndonville, Burke, Morgan and Charleston. Spraying teams used *Bacillus thuringiensis*, or "B.t.," a nontoxic compound that is not a chemical insecticide.

(The Burlington Free Press — November 13, 1983)
Burlington, Vermont

Deer Herd Losing Out to Budworm Infestation. — Greensboro is home to a major population of spruce budworm. It is also the site of Vermont's second-largest deer yard, where 600 to 800 deer spend their winters.

Budworm and deer share a preference for softwood forests, and that affinity worries state officials. As the parasite [sic] feeds on spruce and fir trees, it is destroying the shelter that deer need to survive Vermont's harsh winter. That, in turn, means fewer deer will live until spring.

The winter of 1981-82 was severe for deer. In the Coaticook River basin near Norton, officials found 32 dead deer in an area of about one-sixth of a mile

Deer seek out spruce and fir forests because the boughs keep the snow off the ground. When that snow finally falls to the ground, it is compacted and easier to traverse. Three feet of snow under sugarbush might equal 18 inches to 2 feet of snow in a softwood forest. Softwoods also provide the deer with important thermal protection.

Budworm is changing the habitat drastically. As the cover slowly deteriorates, there will just be forest in smaller areas. Deer begin burning their fat resources to move around in the snow. They gradually will seek out other forests or die of starvation.

(The Burlington Free Press — November 13, 1983)
Burlington, Vermont

Report on Budworm Spraying. — Aerial surveys of New Brunswick forests have found no detectable spruce budworm damage in 74 percent of the "industrial" forest area that was treated with pesticides in the 1983 spray program conducted by Forest Protection Ltd.

Preliminary results of the evaluation of the 1983 program were released recently by the Department of Natural Resources. The department expects to publish a detailed report on the 1983 program by the end of the year.

The relatively small amount of detectable defoliation in the 'industrial' spray areas indicates that the great majority of sprayed areas received good protection from the budworm this year.

(Daily Gleaner — November 3, 1983)
Fredericton, New Brunswick

Recent Publications

CANUSA-East tells us that the Michigan Cooperative Forest Pest Management Program has put out a package of their first series of 1- and 2- page information leaflets. The first, in color, is entitled "Identifying the Spruce Budworm and Its Damage." The others, in black and white, include the effects of spruce budworm outbreaks on trees and stands, identifying stands with the greatest potential for tree mortality, monitoring spruce budworm populations and damage at the stand level, forest management, insecticides, and silviculture.

These leaflets are a product of the Spruce Budworm Technology Transfer Program for the Lake States Region, a CANUSA-supported endeavor headed by Gary Simmons at Michigan State and John Witter at The University of Michigan. For more information, write to Gary (Department of Entomology, MSU, East Lansing, MI 48824) or John (School of Natural Resources, U of M, Ann Arbor, MI 48109).

Bruce Montgomery, John Witter, Gary Simmons, and Randy Rogan, coauthors of "The Spruce Budworm Manual for the Lake States," are enjoying the sweet smell of success: their handbook went into its second printing in October of 1983. If you need a copy, write to Gary or John at the addresses given above, and ask for Technical Manual 82-6.

The American Forestry Association has notified us of their new 144-page directory identifying researchers, teachers, and consultants active in the field of urban forestry. The name, position, organization, address, and phone number of each person is listed. The directory also features three special listings: urban forestry professionals in foreign countries, urban- and community-oriented associations, and urban forestry periodicals. Copies of the "Directory of Urban and Community Forestry Professionals in the U.S. and Canada" can be purchased for \$5 from the American Forestry Association, 1319 18th Street NW, Washington, DC 20036.

Speaking of professional societies, the Winter 1983 issue of the Bulletin of the Entomological Society of America (vol. 29, no. 4) includes two articles by CANUSA cooperators. T. R. Dell, Jackie Robertson, and Mike Haverty contributed "Estimation of Cumulative Change of State with the Weibull Function," and Lorna Youngs wrote "Predaceous Ants in Biological Control of Insect Pests in North American Forests."

From the USDA Forest Service, Southwestern Region, State and Private Forestry, 517 Gold Avenue SW, Albuquerque, NM 87102, you may request a copy of "Biological Evaluation of Western Spruce Budworm, Lincoln National Forest and Mescalero Apache Indian Reservation, New Mexico." Ask for FPM Report R-3.84-3.

At the same address are supplies of Iral Ragenovich's 62-page report on a "Pilot Project to Evaluate the Operational Use of B.t. Against the Western Spruce Budworm in Northern New Mexico, 1981-82." That study involved lands on the Carson National Forest and in State and private ownership. The call number is FPM Report R-3.84-1.

A final entry from the Albuquerque office is Bill Telfer's "Biological Evaluation of Western Spruce Budworm, Santa Fe National Forest, Jemez Indian Pueblo, and Santa Clara Indian Pueblo, New Mexico." The document is FPM Report R-3.84-5.

The "squirt-and-count" set will be interested in George Markin and David Johnson's paper "Carbaryl Applied at Reduced Dosage Rates for Control of Western Spruce Budworm." It is Research Paper PSW-170, available from the USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, 1960 Addison Street, Box 245, Berkeley, CA 94701.

The Great Lakes Forest Research Centre, Box 490, Sault Ste. Marie, Ont. P6A 5M7 has released Information Report O-X-349 by J. H. Meating, H. D. Lawrence, G. M. Howse, and J. R. Carrow entitled "The 1982 Spruce Budworm Situation in Ontario."

Several articles that have recently been published in various journals are of interest. They are as follows:

From the Great Lakes Forest Research Centre at the address shown above, reprints are available of

C. J. Sanders, "Local dispersal of male spruce budworm (Lepidoptera: Tortricidae) moths determined by mark, release, and recapture." The Canadian Entomologist, September 1983.

J. Régnière and R. M. Fletcher. "Direct measurement of spruce budworm (Lepidoptera: Tortricidae) larval dispersal in forest stands." Environ. Entomol. 12(5):1532-1538.

The Laurentian Forest Research Centre, P.O. Box 3800, Ste. Foy, Que. G1V 4C7 can supply

J. R. Blais. "Predicting tree mortality induced by spruce budworm: A discussion." Forest Chronicle, December 1983.

And from the Pacific Forest Research Centre, 506 West Burnside Road, Victoria, B.C. V8Z 1M5 you may request

G. A. Van Sickle, R. I. Alfaro and A. J. Thomson. "Douglas-fir height growth affected by western spruce budworm." Can. J. Forest Res. 13:445-450.

In the Hopper

While *Newsletter* readers romped through the holidays, CANUSA publications personnel put their noses to the grindstone in an effort to keep the USDA series handbooks coming. All of Program Management in the West worked extra hours considering and responding to reviewers' comments on the three users' manuals. "Western Spruce Budworm" is expected to reach the Washington Office for production by mid-March, and "Managing Trees and Stands Susceptible to Western Spruce Budworm" and "Western Spruce Budworm and Forest Management Planning" will come in soon thereafter.

The "big book" from the East, "Managing the Spruce Budworm in Eastern North America" went out for typesetting in early December. By the time you read this, galley proofs should have been received and corrected.

Another large manual in the hopper is Steve Sinclair and Doug Barnes's "Balsam Fir: Properties and Utilization." This book is now being reviewed at the Washington Office Staff level, a mandatory step in the Forest Service's publication process. We estimate that the final, Department of Agriculture-approved text will be ready for typesetting by March, and printing should follow this summer.

"Balsam Fir" doesn't read like the Great American Novel. But if you need to know what this economically important material can — and cannot — do, Sinclair and Barnes will tell you.

The last of the eastern biggies is Alex Shigo's manuscript on the applications of his invention, the Shigometer, in forestry. This device measures electrical resistance in tissues of living trees and provides estimates of their overall health. The text, edited and typed at the Northeastern Forest Experiment Station, is presently out for Washington Office Staff review.

Quite a few shorter handbooks (under 100 typed pages) are moving through the channels. The month of December brought layouts for Paul Adamus's "Techniques for Monitoring the Environmental Impact of Insecticides on Aquatic Ecosystems," Bruce Montgomery's "Insecticides for Control of the Spruce Budworm," and Dan Jennings's "Techniques for Measuring the Early-Larval Dispersal of Spruce and Jack Pine Budworms." Because the layout phase is the last step before printing, we expect all three of these manuals to be available by the time you get this *Newsletter*.

Texts in the galley or reproduction proof stages during the holidays included Dennis Bradley's "Using Computer Simulation to Evaluate Mechanized Harvest Systems," John Dimond's "Planning Insecticide Application and Timber Harvesting in a Spruce Budworm Epidemic," and David Tilles's "Spruce Budworm Parasites in Maine."

These manuscripts are out for typesetting: Ozzie Morris's "Guidelines for the Operational Use of *Bacillus thuringiensis* Against the Spruce Budworm," Richard Reardon's "How to Protect Individual Trees from Western Spruce Budworm by Implants and Injections," Bob Steven's "Lepidoptera Associated with Western Spruce Budworm," Larry Stipe's "Ground Spray Techniques to Reduce Damage from Western Spruce Budworm," and Dan Twardus's "How to Distinguish Between Old and New Egg Masses of the Western Spruce Budworm."

Besides the balsam fir utilization guide and the Shigometry handbook, only one other text is presently in the reviewing stage in Washington. It is "A Guide to Economic Evaluation of Spruce Budworm Management Opportunities," by Michigan State professor Bob Marty. This handbook takes landowners and managers through a step-by-step process to figure out whether insecticide control for budworm is economically feasible on a site-specific basis.

Watch this space in future issues for information about the approximately 16 other CANUSA USDA series publications the Program expects to launch in the rest of Fiscal Year 1984.

Here is a final note about press runs. Present budget restraints in the publications sector of government require that the Forest Service print fewer copies of publications than was common just a few years ago. CANUSA expects to supply all the copies our user groups will need for the short term, but we are prohibited from printing large runs and stockpiling them for future use. To preserve the results of our research, therefore, the Program is placing every USDA series publication into the National Technical Information Service (NTIS). This branch of the U.S. Department of Commerce specializes in photo-reproducing documents and preparing both hard copies and microfiche for a small fee. Once a document is entered into the NTIS catalog, it will remain available indefinitely. In the last issue of this *Newsletter*, projected for November 1984, we will print the NTIS accession numbers and prices for all CANUSA publications entered into the system by the end of the Program, September 30, 1984.

To get more information or to have your name added to the mailing list for the *Newsletter*, contact:

Canada-United States Spruce Budworms Program
USDA Forest Service
P.O. Box 2417, RPE-605
Washington, DC 20013

Canada-United States Spruce Budworms Program
Canadian Forestry Service
19th Floor, Place Vincent Massey
Ottawa, Ont. K1A 1G5